REMARKS/ARGUMENTS

Favorable reconsideration of this application in light of the following discussion is respectfully requested.

Claims 1-2, 4-8, 10-12 and 17-24 are presently active in this case.

In the outstanding Official Action, Claim 1 was objected to for informalities; Claims 1, 2, 5-8, 10-12 and 24 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,589,877 to Thakur in view of Silicon Processing for the VLSI Era, vol. 1: Process Technology to Wolf et al.; Claims 4 and 17-20 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Thakur in view of Wolf et al., and further in view of A Study on Modified Silicon Surface After CHF_3C/C_2F_6 Reactive Ion Etching to Park et al.; Claims 21 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Thakur in view of Wolf et al., and further in view of U.S. Patent Publication 2004/0121605 A1 to Maydan et al.; and Claims 22 and 23 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Thakur in view of Wolf et al. and Maydan et al., and further in view of U.S. Patent No. 6,573,197 to Callegari et al.

Turning now to the merits, Applicants' invention is directed to an improved method of removing defects from a substrate. As discussed in the Background section of Applicants' specification, conventional methods for removing defects grow a sacrificial oxide of greater than 15Å, and then remove the oxide to remove the defects. As also discussed, however, the present inventors recognized that use of such a thick sacrificial oxide creates stress defects that did not previously exist on the surface of the substrate.[1] Applicants' invention addresses this problem by repeatedly growing and removing an ultra thin oxide in order to remove substrate defects.

[1] See Applicants' specification at paragraph 3 and Figures 5A-5G.

Specifically, Applicants' Claim 1 recites thermally growing a first ultra thin oxide layer of ***less than 15Å in total thickness*** on a surface of the substrate to consume defects in a surface region of the substrate, and, ***without forming further oxide on the first ultra thin oxide layer, etching away the first ultra thin layer*** to remove at least some of said consumed defects from the substrate and reveal a subsurface of said substrate. Claim 1 similarly recites that the second ultra thin oxide layer and the additional ultra thin oxide layers are thermally grown, less than 15Å in thickness, and removed without forming further oxide thereon.

The cited reference to Thakur discloses a method of forming a semiconductor device, which may include use of a sacrificial oxide to remove substrate contaminants. As discussed in the July 31, 2006 response, however, Thakur makes clear that a thickness of the oxide after the RTO step 22d is 30-40Å, whether the oxide is performed by step 22d alone or a combination of steps 22a and 22d. That is, although step 22d is ***capable*** of RTO oxide growth of 10Å, this step is repeated or used in combination with step 22a growth to obtain a ***total thickness*** of 30 to 40Å, and this total oxide thickness may be removed as a sacrificial oxide. However, there is no indication in Thakur that the total oxide thickness to be grown and removed is less than 15Å as clearly recited in Claim 1. The cited reference to Wolf et al. is a silicon processing textbook which discloses only general aspects of silicon processing technology. Further, the newly cited reference to Callegari et al. discloses only that an interfacial oxide can be grown at less than 10Å, but this interfacial oxide is never removed and never acts as a sacrificial oxide. Therefore, Wolf et al. and Callegari et al. do not correct the deficiencies of Thakur.

The Official Action acknowledges that the combination of Thakur and Wolf does not disclose growing an oxide layer between 5 and 15Å (or less than 15Å). However, the Official Action states,

> However, the disclosed language in the combination of Thakur and Wolf is open to a non-preferred embodiment wherein the grown oxide has a thickness of less than, for example, 30Å. Furthermore, the combination of Thakur and Wolf teach growing an oxide layer by a rapid thermal oxidation process (RTO), wherein said oxide layer has a thickness of at least generally 10Å (Thakur, column 4, lines 31-35). Although not taught as a preferred embodiment, Thakur in view of Wolf teach this embodiment nonetheless, and disclosed examples and preferred embodiments do not constitute a teaching away from a broader disclosure or non-referred embodiments. In re Susi, 169 USPQ 423 (CCPA 1971).

Thus, the outstanding Office Action apparently takes the position that because the RTO step by itself is capable of 10Å growth, then Thakur teaches a "less preferred embodiment" wherein a total oxide thickness of 10Å is grown and removed from the substrate. Applicants submit that this completely ignores the disclosure in Thakur that the RTO step is used in combination with other steps to provide a total oxide thickness of 30-40Å as discussed above. In this regard, Applicants note that it is the present inventors who discovered that growth and removal of an ultra thin sacrificial oxide layer provides the advantages of reduced stress defects on the substrate surface. Although Thakur is "open to" or capable of many possibilities, there is nothing in Thakur that would lead one of ordinary skill in the art to grow a sacrificial oxide having a total thickness of less than 15Å, and then remove such ultra thin oxide, as required by the claimed invention. Thus, Thakur does not disclose growing a first ultra thin oxide layer of less than 15Å in total thickness... and without forming further oxide on the first ultra thin oxide layer, etching away the first ultra thin oxide layer.

In addition, Applicants' Claim 1 requires monitoring the surface region of the substrate for additional defects, and repeatedly growing and etching an additional ultra thin oxide layer to consume the additional defects to provide a substantially contaminant free substrate surface. The Office Action also acknowledges that the combination of Thakur and Wolf et al. does not disclose this limitation but concludes that the limitation is inherent. As

discussed in the July 31st response, such monitoring is not necessary because the oxide growth and etch process could be stopped after an arbitrary number of cycles based on historical data. This requires no monitoring of the substrate surface at all. The Office Action responds by stating:

> [i]n order to obtain historical data, several results must have been obtained. At some point, there has to be a monitoring of test substrates in order to obtain results that would be recorded and treated as historical data.

Applicants respectfully disagree. One does not have to ***monitor the surface region of a substrate*** to obtain historical data on a process step. For example, the historical data may be based on the electrical characteristics of an end device. Moreover, the Office Action analyzes the monitoring step completely out of context. Applicants' Claim 1 does not recite just any monitoring of any substrate to obtain data. Rather the claim recites monitoring a surface region of the substrate that the ultra thin oxide is repeatedly grown on and removed from to remove defects. The monitoring determines the number of repeated growth/removal steps. This particular monitoring does not necessarily result from the cited references and is therefore not inherent. Thus, Applicants' monitoring step provides an additional basis for patentability of Claim 1 over the cited references.

As Applicants Claim 1 patentably defines over the cited references as discussed above, the remaining dependent claims also patentably define over the cited references. Applicants further note, however, that dependent Claims 2 and 17-20 relate to further details of monitoring a surface of the substrate for defects. Thus, these claims provide an additional basis for patentability over the cited references.

Finally, Claim 24 recites the same limitations as Claim 1, except that the oxide layer grown and removed is approximately 5-10 Å. Thus, Applicants' Claim 24 recites a narrower range than Claim 1 and is patentable over the cited references for the reasons discussed above.

Consequently, in view of the present amendment, no further issues are believed to be outstanding in the present application and the present application is believed to be in condition for formal allowance. An early and favorable action is therefore respectfully requested.

Respectfully submitted,

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